

# Capability Maturity Model Integration (CMMI) and Acquisition

Robert Vickroy  
United Space Alliance, LLC

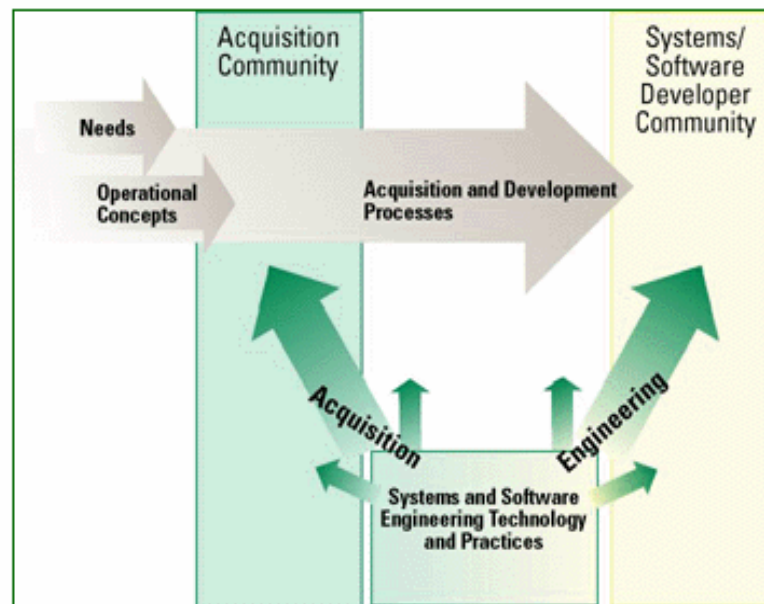
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## Acquisition Support Program - About Us

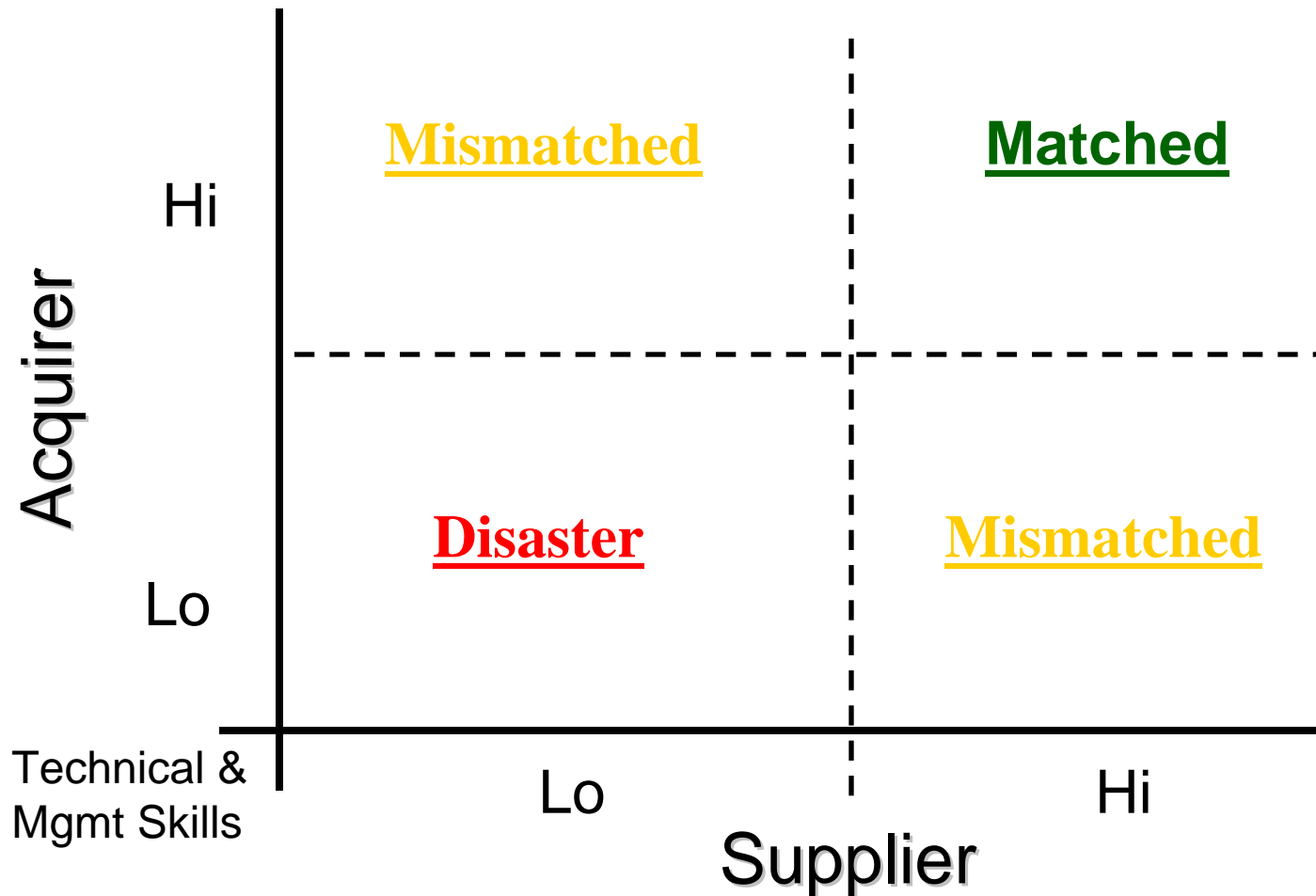
[Purpose](#) | [Program Activities](#) | [How ASP Can Help](#) | [For More Information](#)

Acquisition program managers are challenged not only to grasp practical business concerns, but also to understand topics as diverse as risk identification and mitigation, selection and integration of commercial off-the-shelf (COTS) components, process capability, program management, architecture, survivability, interoperability, source selection, and contract monitoring. The SEI has spent almost two decades compiling a body of knowledge and developing solutions for these topics.



The vision of the Acquisition Support Program is to facilitate the rapid establishment of agile teams composed of acquirers, developers, and operators using SEI technologies to provide evolutionary, high-quality, cutting-edge software-intensive capabilities to the war-fighter.

# Impact of Maturity



CMMI Acquisition Model, Brian Gallagher, CMMI Technology Conference, 15-10-04

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# CMMI Acquisition Module

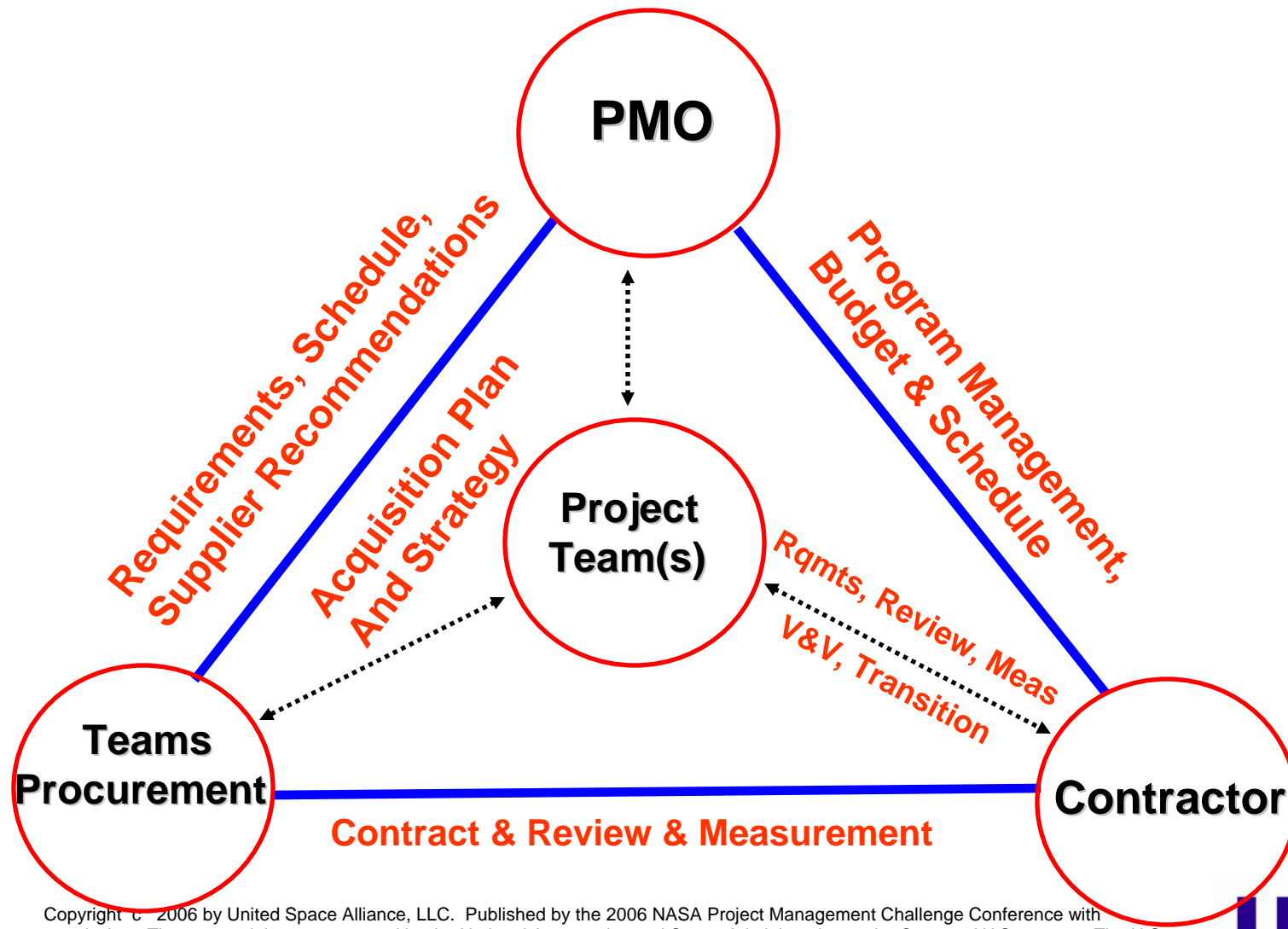
## Draws from best practices found in:

- CMMI
- Software Acquisition CMM (SA-CMM)
- Integrated Capability Maturity Model (FAA-iCMM)

To be added to CMMI Version 1.2, after 8-2006.

Enhances the CMMI to facilitate the integration of The PMO, Project and Contractor in the acquisition process.

# Triangle for Success in Acquisition



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# CMMI Process Categories/ Areas

<u>Process Mgmt</u>	<u>Project Mgmt</u>	<u>Engineering</u>	<u>Support</u>
	<ul style="list-style-type: none"> <li>• Proj Planning</li> <li>• <i>Proj Monitoring &amp; Control</i></li> <li>• Supplier Agreement Mgmt</li> </ul>	<ul style="list-style-type: none"> <li>• Requirements Mgmt</li> </ul>	<ul style="list-style-type: none"> <li>• Configuration Mgmt</li> <li>• <i>Process &amp; product QA</i></li> <li>• Measurement &amp; Analysis</li> </ul>
<ul style="list-style-type: none"> <li>• <i>Org Process Focus</i></li> <li>• Org Process Definition</li> <li>• <i>Org Training</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>Integrated Proj Mgmt</i></li> <li>• Risk</li> </ul>	<ul style="list-style-type: none"> <li>• <i>Requirements Development</i></li> <li>• <i>Technical Solution</i></li> <li>• <i>Product Integration</i></li> <li>• Ver &amp; Val</li> </ul>	<ul style="list-style-type: none"> <li>• <i>Decision Analysis &amp; Resolution</i></li> </ul>
<ul style="list-style-type: none"> <li>• Org Process Performance</li> </ul>	<ul style="list-style-type: none"> <li>• Quantitative Project Mgmt</li> </ul>		
<ul style="list-style-type: none"> <li>• <i>Org Innovation &amp; Deployment</i></li> </ul>			<ul style="list-style-type: none"> <li>• <i>Corrective Action &amp; Resolution</i></li> </ul>
	<ul style="list-style-type: none"> <li>• Integrated Product &amp; Process Development</li> <li>• <i>Integrated Teaming</i></li> </ul>		<ul style="list-style-type: none"> <li>• Org Environment For Integration</li> </ul>
	<ul style="list-style-type: none"> <li>• <i>Integrated Supplier Mgmt</i></li> </ul>		

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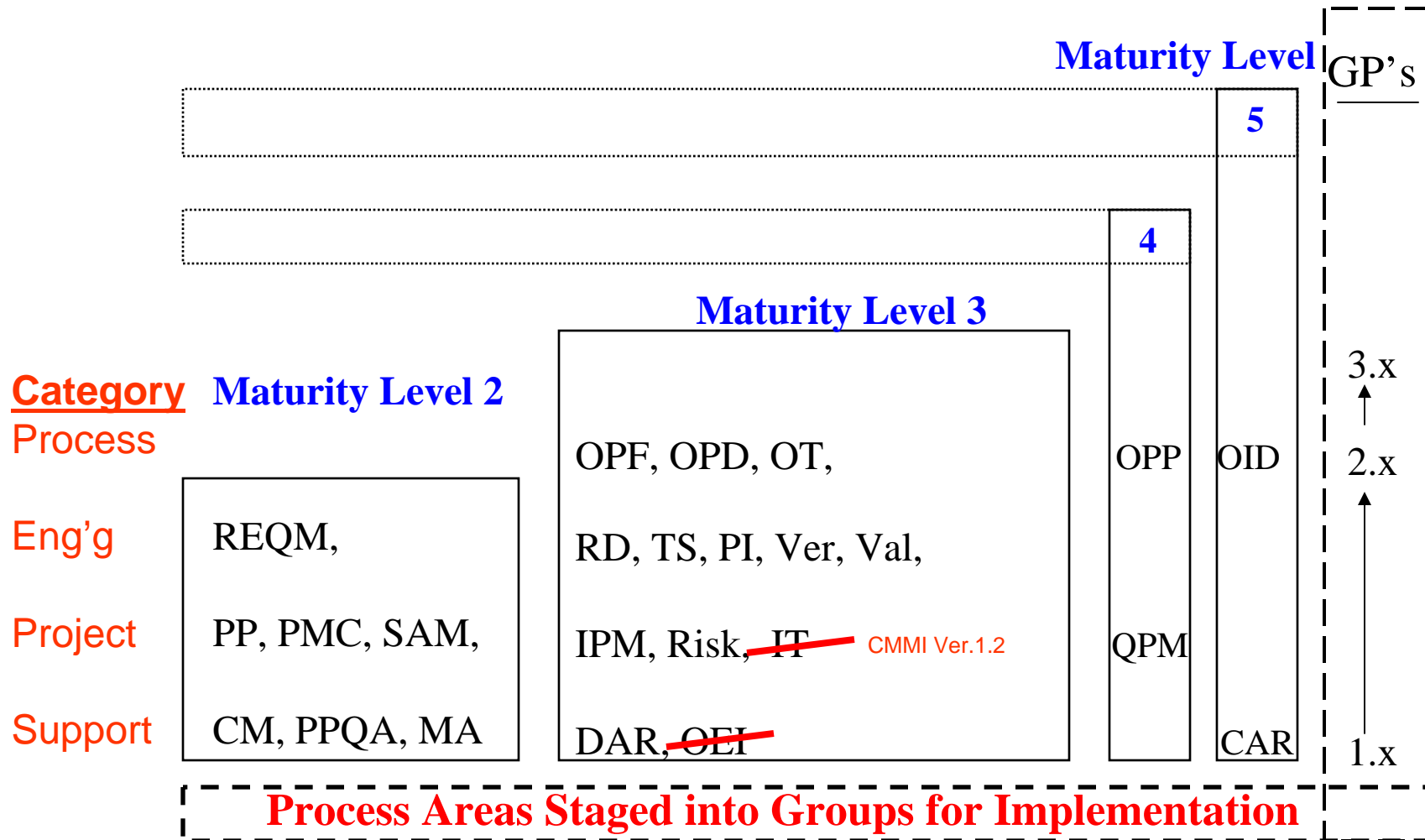
# CMMI Process Categories/ Areas

	<u>Process Mgmt</u>	<u>Project Mgmt</u>	<u>Engineering</u>	<u>Support</u>
2		<ul style="list-style-type: none"> <li>• Proj Planning</li> <li>• <i>Proj Monitoring &amp; Control</i></li> <li>• <b>Supplier Agreement Mgmt</b></li> </ul>	<ul style="list-style-type: none"> <li>• Requirements Mgmt</li> </ul>	<ul style="list-style-type: none"> <li>• Configuration Mgmt</li> <li>• <i>Process &amp; product QA</i></li> <li>• Measurement &amp; Analysis</li> </ul>
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4	<ul style="list-style-type: none"> <li>• <b>Org Process Performance</b></li> </ul>	<ul style="list-style-type: none"> <li>• Quantitative Project Mgmt</li> </ul>		
5	<ul style="list-style-type: none"> <li>• <b>Org Innovation &amp; Deployment</b></li> </ul>			<ul style="list-style-type: none"> <li>• <b>Corrective Action &amp; Resolution</b></li> </ul>
IPPD		<ul style="list-style-type: none"> <li>• <b>Integrated Product &amp; Process Development</b></li> <li>• <b>Integrated Teaming</b></li> <li>• <b>Integrated Supplier Mgmt</b></li> </ul>		<ul style="list-style-type: none"> <li>• <b>Org Environment For Integration</b></li> </ul>
SS				

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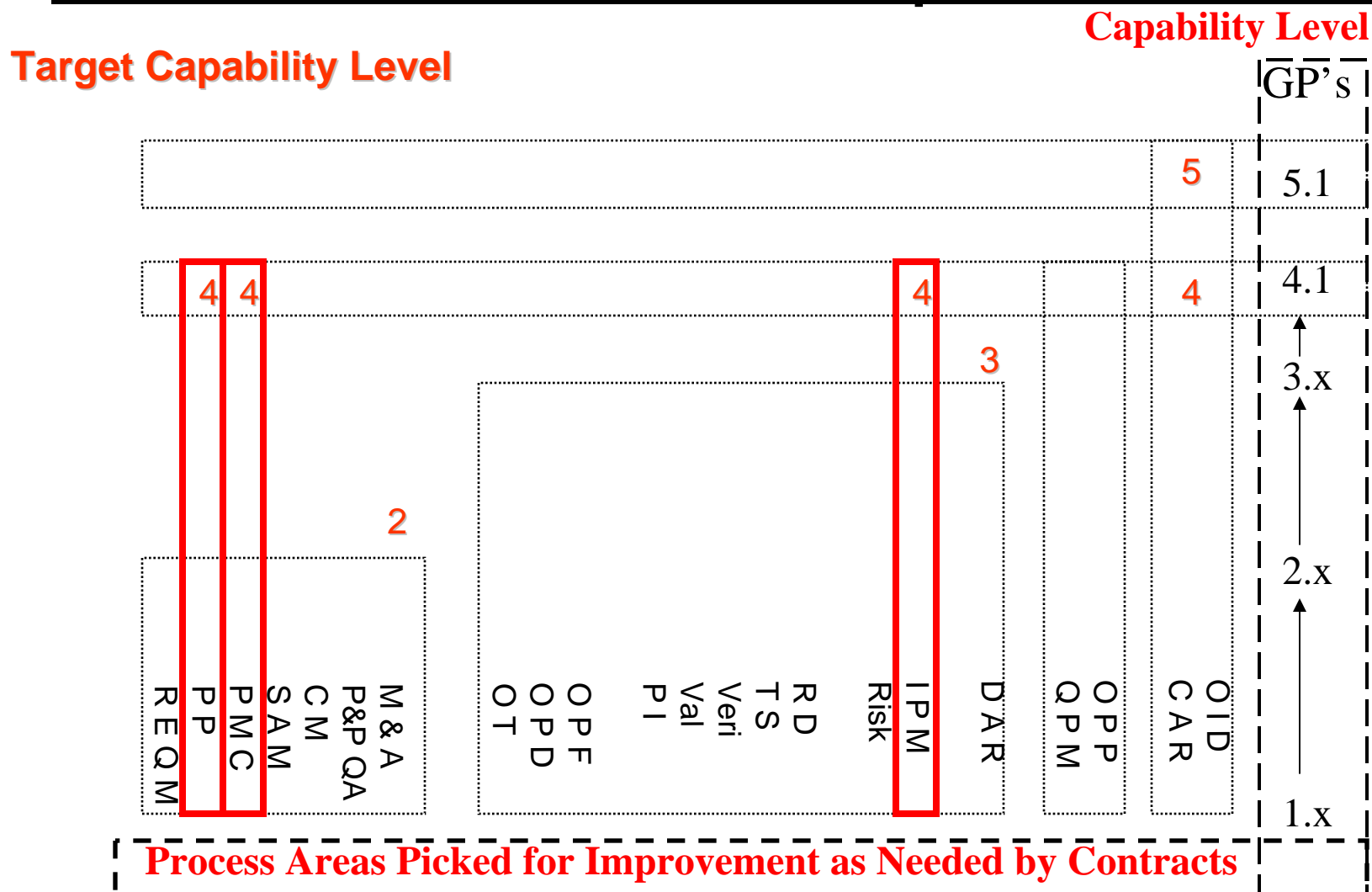


# CMMI Staged Representation





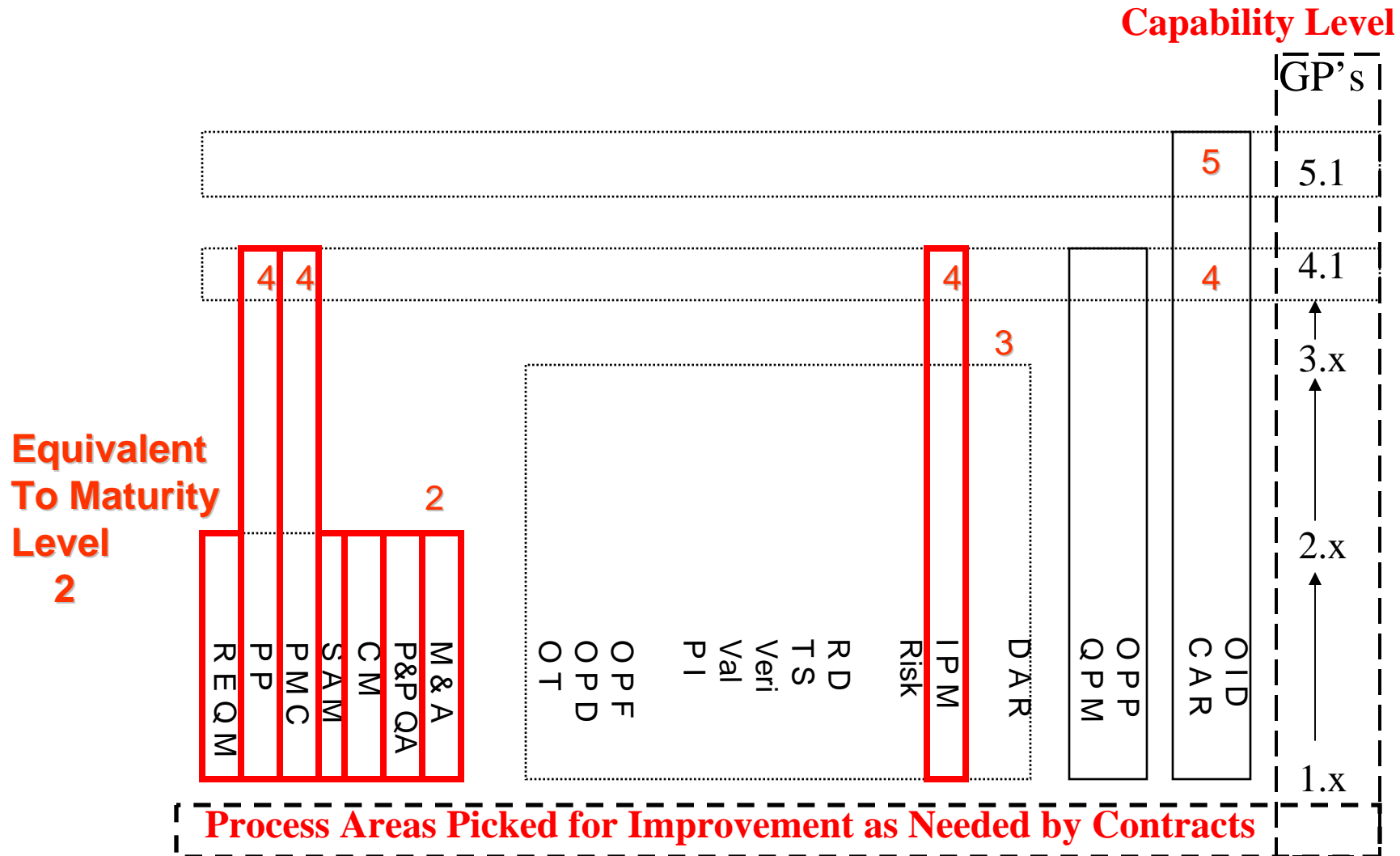
# CMMI Continuous Representation



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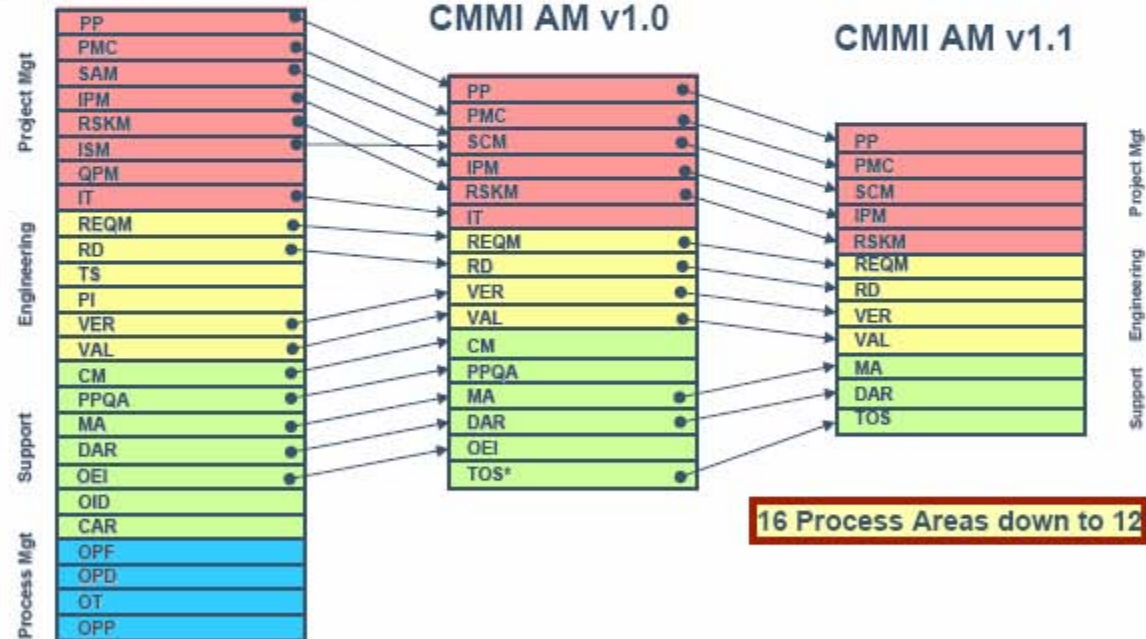


# CMMI Equivalent Staging

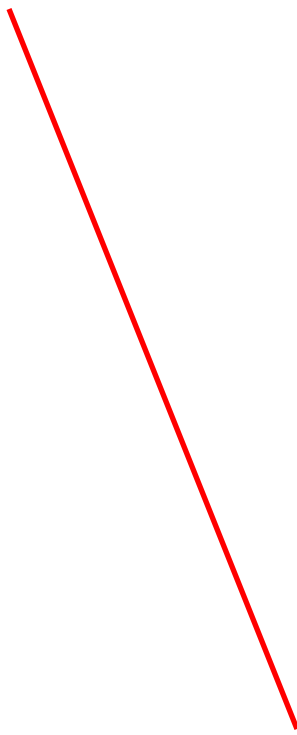


## Evolution of the CMMI-AM v1.1

### CMMI SE/SW/SS v1.1 (Continuous Representation)



# CMMI Acquisition Model Process Areas

<u>Process Mgmt</u>	<u>Project Mgmt</u>	<u>Engineering</u>	<u>Support</u>
	<ul style="list-style-type: none"> <li>• Proj Planning</li> <li>• <i>Proj Monitoring &amp; Control</i></li> <li>• <b>Solicitation &amp; Contract Monitoring</b></li> <li>• <i>Integrated Proj Mgmt</i></li> <li>• <i>Risk Mgmt</i></li> </ul>	<ul style="list-style-type: none"> <li>• Requirements Mgmt</li> <li>• <i>Requirements Development</i></li> <li>• <i>Verification</i></li> <li>• <i>Validation</i></li> </ul>	<ul style="list-style-type: none"> <li>• Measurement &amp; Analysis</li> <li>• <i>Decision Analysis &amp; Resolution</i></li> <li>• <b>Transition to Operation &amp; Support</b></li> </ul>

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# Process Area Format

## Process Area

- Purpose
- Specific Goals
- Specific Practices

## And there are:

- Specific Practices – apply to all PA's

# Generic Practices

## PRACTICES – that apply to all Process Areas

1. **E & M** an organizational policy for planning and performing the process
2. **E & M** the **plan** for performing the **process**
3. **Provide adequate resources** for performing the process, developing the work products, and providing the services of the process
4. **Assign responsibility and authority** for performing the process, developing the work products, and providing the services of the process
5. **Train the people** performing or supporting the process as needed
6. Place **designated work products** of the process under appropriate levels of configuration management
7. **Identify and involve the relevant stakeholders** as planned
8. **Monitor and control the process** against the plan for performing the process and take appropriate corrective action
9. **Objectively evaluate adherence** of the process against its process description, standards, and procedures, and address noncompliance
10. **Review the activities, status, and results** of the process with higher level management and resolve issues

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**Note:** **E & M** = *Establish & Maintain = Document & Use Across organization*

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# Project Planning

<u>GOALS</u>	<u>PRACTICES</u>
<b>1. Estimates of project planning parameters</b> <b>Established &amp; Maintained</b>	<b>1.1 Establish</b> top level WBS to estimate the scope of project <b>1.2 E &amp; M</b> estimates of attributes of the work products & tasks <b>1.3</b> Define project lifecycle phases upon which to scope the plan <b>1.4</b> Estimate project effort & cost for work products & tasks....
<b>2. Project plan is</b> <b>Established &amp; Maintained</b>	<b>2.1 E &amp; M</b> budget & schedule <b>2.2</b> Identify and analyze project risk <b>2.3</b> Plan for management of project data <b>2.4</b> Plan for necessary resources to perform project <b>2.5</b> Plan for knowledge & skills to perform project <b>2.6</b> Plan for involvement of identified stakeholders <b>2.7 E &amp; M</b> overall project plan content
<b>3. Commitments to project plan</b> <b>Established &amp; Maintained</b>	<b>3.1</b> Review all plans affect project to understand project commits <b>3.2</b> Reconcile the project plan to reflect available & est. resources <b>3.3</b> Obtain commitments from relevant stakeholders to perform & support plan execution

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## Planning & Monitoring

- 1. Identify Process Needs:** *self-assessment*
- 2. Source Selection Criteria:** *ID processes*
- 3. RFP response:** *processes /outputs / artifacts*
- 4. Evaluate GAP to “needs”:** *SCAMPI “C”*
- 5. Contract:** *“Contractor perform as proposed”*
- 6. Process Compliance:** *SCAMPI “C”*



# Project Monitoring & Control

<u>GOALS</u>	<u>PRACTICES</u>
<b>1. Actual performance &amp; progress of project are monitored against the project plan</b>	<p>1.1 Monitor the actual values of the project planning parameters....</p> <p>1.2 Monitor commitments to those identified in the project plan</p> <p>1.3 Monitor risks against those In the project plan</p> <p>1.4 Monitor the management of the project data against the plan</p> <p>1.5 Monitor stakeholder involvement against the project plan</p> <p>1.6 Periodically review the project progress, performance &amp; issues</p> <p>1.7 Review the accomplishments &amp; results of the project at selected milestones</p>
<b>2. Corrective actions are managed to closure when the project's performance or results deviate significantly From the plan</b>	<p>2.1 Collect &amp; analyze the issues &amp; determine the corrective actions necessary to address the issues.</p> <p>2.2 Take corrective action on identified issues</p> <p>2.3 Manage corrective actions to closure</p>

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# CMMI vs. AM Solicitation, Agreement, Sources

<u>CMMI/AM:Solicitation &amp; Contract Monitoring</u>	<u>CMMI:Supplier Agreement Mgmt (SAM P.A.)</u>	<u>CMMI:Integrated Supplier Mgmt (in SAM)</u>
<b>SG1</b> The project is prepared to conduct solicitation.	<b>SG1</b> Agreement with suppliers are <b>established (E) &amp; maintained (M)</b> .	<b>SG1</b> Potential sources of products that best fit the needs of the project are <b>identified, analyzed, and selected</b> .
<b>1.1</b> Designate a selection official responsible for making the selection decision.		
<b>1.2 E &amp; M</b> a <b>solicitation package</b> that includes the needs of the acquisition and corresponding proposal evaluation criteria.	<b>SP1.1</b> Determine type of <b>acquisition</b> for each product or product component to be acquired. <i>Ref: TS PA.</i>	<b>SP1.1</b> Identify and analyze <b>potential sources</b> of products that may be used to satisfy the projects requirements. <i>Ref: OID PA.</i>

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# CMMI vs. AM Solicitation Package

<u>CMMI/AM:Solicitation &amp; Contract Monitoring</u>	<u>CMMI:Supplier Agreement Mgmt (SAM P.A.)</u>	<u>CMMI:Integrated Supplier Mgmt (in SAM)</u>
<b>1.3 E &amp; M independently reviewed cost &amp; schedule estimates</b> for the products to be acquired.		
<b>1.4 Validate the solicitation package</b> with end users and potential offerors to ensure the approach and cost and schedules estimates are realistic and can reasonably lead to a usable product.		
<b>SG2 Suppliers are selected</b> based on the solicitation package.		
<b>2.1 Evaluate proposals</b> according to the documented evaluation criteria.		

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# CMMI vs. AM Evaluation, Selection, Contract

<u><b>CMMI/AM:Solicitation &amp; Contract Monitoring</b></u>	<u><b>CMMI:Supplier Agreement Mgmt (SAM P.A.)</b></u>	<u><b>CMMI:Integrated Supplier Mgmt (in SAM)</b></u>
<b>2.2</b> Use <b>proposal evaluation results as a basis to support selection</b> decisions.	<b>SP1.2 Select suppliers based on evaluation</b> of their ability to meet the specified requirements and establish criteria. <i>Ref: DAR, RM PA's.</i>	<b>SP1.2 Use formal evaluation process</b> to determine which sources of custom-made and off-the-shelf products to use. <i>Ref: DAR PA.</i>
<b>SG3 Contracts are issued</b> based on the needs of the acquisition and the suppliers' proposed approaches.	<b>SP 1.3 E &amp; M formal agreements with suppliers.</b> <i>Ref: RD, RM, PMC.</i>	
<b>3.1 E &amp; M a mutual understanding of the contract</b> with selected suppliers and end users based on the acquisition needs and the suppliers' proposed approaches.	( <b>SP1.3.4</b> Ensure all parties to the agreement understand and agree to all requirements before implementing the agreement.)	
<b>3.2 E &amp; M communication processes &amp; procedures with suppliers</b> that emphasis the needs, expectations, and measurements of effectiveness to be used throughout the acquisition.		

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# CMMI vs. AM Coordinate, and Monitor Process and Product

<u><b>CMMI/AM:Solicitation &amp; Contract Monitoring</b></u>	<u><b>CMMI:Supplier Agreement Mgmt (SAM P.A.)</b></u>	<u><b>CMMI:Integrated Supplier Mgmt (in SAM)</b></u>
<b>SG4 Work is coordinated with suppliers</b> to ensure the contract is executed properly.	<b>SG2 Agreements with suppliers are satisfied</b> by both the project and the supplier.	<b>SG2</b> Work is coordinated with suppliers to <b>ensure the supplier agreement is executed appropriately.</b>
<b>4.1 Monitor and evaluate selected processes</b> used by the supplier based on the suppliers' documented processes.	<b>SP2.1 Review candidate COTS products</b> to ensure they satisfy the specified requirements that are covered under a supplier agreement. <i>Ref: RD, ISM-SG1, PP, Risk.</i>	<b>SP2.1 Monitor and analyze selected processes</b> used by the supplier. <i>Ref: Ver, PMC PA's.</i>
<b>4.2 Evaluate selected supplier work products</b> based on documented evaluation criteria.	<b>SP2.2 Perform activities with the supplier</b> as specified in the supplier agreement. <i>Ref: ISM-SG1, PMC PA's.</i>	<b>SP2.2 For custom-made products, evaluate selected supplier work products.</b> <i>Ref: PMC PA.</i>

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# CMMI vs. AM Change Control, Acceptance, Transition

<u>CMMI/AM:Solicitation &amp; Contract Monitoring</u>	<u>CMMI:Supplier Agreement Mgmt (SAM P.A.)</u>	<u>CMMI:Integrated Supplier Mgmt (in SAM)</u>
<b>4.3 Revise the supplier agreement or relationship</b> , as appropriate, to reflect changes in conditions.	( <b>SP1.3.5</b> Revise the supplier agreement as necessary.)	<b>SP2.3 Revise the supplier agreement or relationship</b> , as appropriate, to reflect changes in conditions. <i>Ref: SAM SP1.3 PA's.</i>
	<b>SP2.3 Ensure that the supplier agreement is satisfied</b> before accepting the acquired product. <i>Ref: Ver, PMC PA's.</i>	
	<b>SP2.4 Transition the acquired product</b> from the supplier to the project. <i>Ref: PI PA.</i>	

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# Integrated Project Mgmt

<u>GOALS</u>	<u>PRACTICES</u>
<b>1. The project is conducted using a defined process that is tailored from the organizations set of standard processes</b>	<p><b>1.1 E &amp; M</b> the projects defined process</p> <p><b>1.2</b> Use the organizations process assets &amp; measurement repository for estimating &amp; planning project activities</p> <p><b>1.3</b> Integrated the project plan &amp; the other plans that affect the project to describe the project's defined process</p> <p><b>1.4</b> Manage the project using the project plan, other plans that affect the project, and the project's defined process</p> <p><b>1.5</b> Contribute work products, measurements, &amp; documented experiences to the organizational process assets</p>
<b>2. Coordination &amp; collaboration of the project with relevant stakeholders are conducted</b>	<p><b>2.1</b> Manage the involvement of relevant stakeholders in the project</p> <p><b>2.2</b> Participate with relevant stakeholders to identify, negotiate, &amp; track critical dependencies</p>

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# Risk Management

<u>GOALS</u>	<u>PRACTICES</u>
<b>1. Preparation for risk management is conducted</b>	<p>1.1 Determine risk sources &amp; categories</p> <p>1.2 Define the parameters used to analyze &amp; categorize risks &amp; the parameters used to control the risk management effort</p> <p>1.3 <b>E &amp; M</b> the strategy to be used for risk management</p>
<b>2. Risks are identified and analyzed to determine their relative importance</b>	<p>2.1 Identify &amp; document the risks</p> <p>2.2 Evaluate &amp; categorize each identified risk using the defined risk categories &amp; parameters, &amp; determine its relative priority</p>
<b>3. Risks are handled and mitigated, where appropriate, to reduce adverse impacts on achieving objectives</b>	<p>3.1 Develop a risk mitigation plan for the most important risks to the project, as defined by the risk management strategy</p> <p>3.2 Monitor the status of each risk periodically &amp; implement the risk mitigation plan as appropriate</p>

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# Requirements Development

<u>GOALS</u>	<u>PRACTICES</u>
<b>1. Stakeholder needs, expectations, constraints, &amp; interfaces are collected &amp; translated into customer requirements</b>	<p>1.1 Elicit stakeholder needs, expectations, constraints, and interfaces for all phases of the product life cycle</p> <p>1.2 Transform stakeholder needs, expectations, constraints, and interfaces into customer requirements</p>
<b>2. Customer Requirements are refined and elaborated to develop product &amp; product-component requirements</b>	<p>2.1 <b>E &amp; M</b> product and product-component requirements, which are based on the customer requirements</p> <p>2.2 Allocate the requirements for each product component</p> <p>2.3 Identify interface requirements</p>
<b>3. The requirements are analyzed &amp; validated, &amp; a definition of required functionality is developed</b>	<p>3.1 <b>E &amp; M</b> operational concepts &amp; associated scenarios</p> <p>3.2 <b>E &amp; M</b> a definition of required functionality</p> <p>3.3 Analyze requirements to ensure they are necessary &amp; sufficient</p> <p>3.4 Analyze requirements to balance stakeholder needs &amp; constraints</p> <p>3.5 Validate requirements to ensure the resulting product will perform as intended in the user's environment ....</p>

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# Requirements Management

<u>GOALS</u>	<u>PRACTICES</u>
<b>1. Requirements are managed &amp; inconsistencies with project plans &amp; work products are identified</b>	<p>1.1 Develop an understanding with the requirements providers on the meaning of the requirements</p> <p>1.2 Obtain commitment to the requirements from the project participants</p> <p>1.3 Manage changes to the requirements as they evolve during the project</p> <p>1.4 Maintain bidirectional traceability among the requirements and the project plans and work products</p> <p>1.5 Identify inconsistencies between the project plans and work products and the requirements</p>

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# Verification

<u>GOALS</u>	<u>PRACTICES</u>
<b>1. Preparation for verification is conducted</b>	<p>1.1 Select the work products to be verified &amp; the verification methods that will be used for each</p> <p>1.2 <b>E &amp; M</b> the environment needed to support verification</p> <p>1.3 <b>E &amp; M</b> verification procedures &amp; criteria for the selected work products</p>
<b>2. Peer reviews are performed on selected work products</b>	<p>2.1 Prepare for peer reviews of selected work products</p> <p>2.2 Conduct peer reviews on selected work products and identify issues resulting from the peer review</p> <p>2.3 Analyze data about preparation, conduct, and results of the peer reviews</p>
<b>3. Selected work products are verified against their specific requirements</b>	<p>3.1 Perform verification on the selected work products</p> <p>3.2 Analyze the results of all verification activities &amp; identify corrective action</p>

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# Validation

<u>GOALS</u>	<u>PRACTICES</u>
<b>1. Preparation for validation is conducted</b>	<p>1.1 Select products &amp; product components to be validated &amp; the validation methods that will be used for each</p> <p>1.2 <b>E &amp; M</b> the environment needed to support validation</p> <p>1.3 <b>E &amp; M</b> procedures &amp; criteria for validation</p>
<b>2. The product or product components are validated to ensure that they are suitable for use in their intended environment</b>	<p>2.1 Perform validation on the selected products &amp; product components</p> <p>2.2 Analyze the results of the validation activities &amp; identify issues</p>

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# Decision Analysis & Resolution

<u>GOALS</u>	<u>PRACTICES</u>
<b>1. Decisions are based on an evaluation of alternatives using established criteria</b>	<p>1.1 <b>E &amp; M</b> guidelines to determine which issues are subject to a formal evaluation process</p> <p>1.2 <b>E &amp; M</b> the criteria for evaluating alternatives and the relative ranking of these criteria</p> <p>1.3 Identify alternative solutions to address issues</p> <p>1.4 Select the evaluation methods</p> <p>1.5 Evaluate alternative solutions using the established criteria &amp; methods</p> <p>1.6 Select solutions from the alternatives based on the evaluation criteria</p>

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# Measurement & Analysis

<u>GOALS</u>	<u>PRACTICES</u>
<b>1. Measurement objectives &amp; activities are aligned with identified information needs &amp; objectives</b>	<p>1.1 <b>E &amp; M</b> measurement objectives that are derived from identified information needs &amp; objectives</p> <p>1.2 Measures to address the measurement objectives</p> <p>1.3 Specify how measurement data will be obtained and stored</p> <p>1.4 Specify how measurement data will be analyzed &amp; reported</p>
<b>2. Measurement results that address identified information needs &amp; objectives are provided</b>	<p>2.1 Obtain specified measurement data</p> <p>2.2 Analyze &amp; interpret measurement data</p> <p>2.3 Manage &amp; store measurement data, measurement specifications, &amp; analysis results</p> <p>2.4 Report results of measurement &amp; analysis activities to all relevant stakeholders</p>

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# Transition to Operations & Support

<u>GOALS</u>	<u>PRACTICES</u>
<b>1. Preparation for transition to operations &amp; support is conducted</b>	<p><b>1.1 E &amp; M</b> a strategy for transition to operations &amp; support</p> <p><b>1.2 E &amp; M</b> plans for transitioning products into operational use/support</p> <p><b>1.3 E &amp; M</b> training requirements for operational &amp; support personnel</p> <p><b>1.4 E &amp; M</b> initial &amp; life-cycle resource requirements for performing operations &amp; support</p> <p><b>1.5</b> Identify &amp; assign organizational responsibility for support</p> <p><b>1.6 E &amp; M</b> criteria for assigning responsibility for enhancements</p> <p><b>1.7 E &amp; M</b> transition criteria for the acquired products</p>
<b>2. Transition decisions &amp; actions are executed in accordance with transition criteria</b>	<p><b>2.1</b> Evaluate the readiness of the acquired products to undergo transition to operations &amp; support</p> <p><b>2.2</b> Evaluate the readiness of the operational &amp; support personnel to assume responsibility for the acquired products</p> <p><b>2.3</b> Analyze the results of all transition activities &amp; identify action</p> <p><b>2.4</b> Report results of measurement &amp; analysis activities to all relevant stakeholders</p>

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# Summary

- The Acquisition Module allows the organization managing the acquisition to integrate the activities of the acquisition organization(s), contractor(s), development (Hdwr, SW, Procurement-team(s)).
- The overall goal is the delivery of contracted products and services on-time, within budget with the required functionality.